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Brookhaven National Laboratory
Major Petroleum Facility
and Central Steam Facility

Facility Environmental Monitoring Report

Calendar Year 2001

BROOKHAVEN
NATIONAL LABORATORY

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Summary of Results*: Analysis of environmental samples collected at the Major Petroleum Facility and Central Steam Facility during 2001 indicates that current operations are not impacting air or groundwater quality. No fuel related chemicals were detected in the groundwater. Continuous emission monitoring data and No. 6 fuel oil analytical sample results collected during 2001 confirm that the four boilers at the Central Steam Facility are fully compliant with applicable emission standards and with NYSDEC operating permits.*

Soil samples collected in October 2001 at SPDES Outfall 010 had lead concentrations ranging from 2,120 mg/Kg to 55,200 mg/Kg. These concentrations exceed the 400 mg/Kg Action Level for soil cleanup established by the Suffolk County Department of Health Services. Available information suggests that the lead observed in the soils originates from water washing of ash/slag buildup in the boilers from the mid 1970s through the early 1980s. Wastewater generated by this process was discharged to the CSF floor drains, which until the early 1980's discharged to the storm water collection system.

Background

The Major Petroleum Facility (MPF) is the holding area for fuels used at the Central Steam Facility (CSF). Fuel oil for the CSF is held in a network of seven above ground storage tanks, two of which are currently inactive. The tanks, which have a combined capacity to contain up to 1.7 million gallons of #6 fuel oil and 660,000 gallons of #2 fuel oil, are connected to the CSF by above ground pipelines that have secondary containment and leak detection devises. All fuel storage tanks are located in bermed containment areas that have a capacity to hold >110% of the volume of the largest tank located within each bermed area. The bermed areas have bentonite clay liners consisting of either Environmat (consisting of bentonite clay sandwiched between geotextile material) or bentonite clay mixed into the native soils to form an impervious soil/clay layer. As of December 1996, all fuel unloading operations were consolidated in one centralized building that has secondary containment features. The MPF is operated under a New York State Department of Environmental Conservation (NYSDEC) permit (Permit #1-1700), and as required by law, a Spill Prevention Control and Countermeasures Plan and a Facility Response Plan have been developed for the facility (BNL, 2000a; BNL, 2000b).

The CSF uses four boilers to supply steam for heating and cooling to BNL major

facilities through an underground steam distribution and condensate grid. To control emissions of nitrogen oxides (NOx), a pollutant that contributes to the formation of ozone in the lower atmosphere, both the USEPA and the NYSDEC have enacted regulatory requirements that restrict NOx emissions from large and midsize boilers. The CSF uses a combination of engineering and administrative controls to comply with applicable NOx emission standards.

For Boilers Nos. 1A and 5, compliance with the NOx emission standard of 6 NYCRR Part 227-2 is achieved through the use of low excess air burners. Initial compliance with this standard was demonstrated through stack testing conducted in January 1995 while each boiler burned No. 6 oil with fuel nitrogen and sulfur contents of less than 0.3 percent. To help to ensure compliance with the NOx limits, all CSF contracts with No. 6 oil suppliers specify that No. 6 oil delivered to the MPF have a nitrogen content not greater than 0.3 percent by weight.

In addition to the emission limits of 6 NYCRR Part 227-2, Boiler Nos. 6 and 7 must comply with NOx emission limits of New Source Performance Standard, 40 CFR 60 Subpart Db. Boiler No. 7 must also comply with 40 CFR 60 Subpart Db stack opacity monitoring requirements. Both boilers use dual fired low NOx burners to meet the emission standards. To demonstrate initial compliance with the Subpart Db standard, stack tests were conducted on Boilers 6 and 7 in October 1991 and May 1996 respectively. In accordance with Subpart Db requirements, NOx continuous emission monitors are used on both boilers and a continuous opacity monitoring system is used on Boiler 7 to ensure continuous compliance with the NOx and opacity standards.

Environmental Monitoring Program

BNL has established air, groundwater and stormwater discharge monitoring programs at the CSF and MPF to evaluate potential impacts to environmental quality and to demonstrate compliance with DOE requirements and applicable federal, state and local laws, regulations and permits. The environmental monitoring program for the MPF is described in the BNL Environmental Monitoring Plan (Daum *et al*. 2000; BNL, 2001).

Monitoring Results

Air

The primary objective of air monitoring efforts at the CSF is to verify compliance with applicable federal and state NOx emission and opacity standards. This is accomplished either through periodic monitoring of residual fuel deliveries to the MPF or continuous monitoring of NOx and opacity emissions through monitoring ports in stacks for Boilers 6 and 7. Monitoring results were provided to the NYSDEC on a quarterly basis (Cunniff, 2001a; Cunniff, 2001c; Cunniff, 2001d; Cunniff, 2002)

Since there are no continuous emissions monitoring requirements for Boilers 1A and 5, the CSF uses the measured nitrogen content from composite samples of No. 6 fuel

deliveries to the MPF during the quarter as a surrogate indicator for compliance with NOx emission standards. Continued compliance with the emission standard is presumed so long as laboratory analysis of composite residual fuel samples confirms the fuel nitrogen content does not exceed 0.3 percent by weight. Analysis of composite samples of residual fuel oil deliveries to MPF storage tanks during each quarter of CY 2001 confirmed that the fuel bound nitrogen content of No. 6 oil burned was less than 0.3 percent by weight.

From May 1 to September 15 (the peak ozone period), compliance of Boilers 6 and 7 with the NOx emissions limits was demonstrated by calculating the 24-hour average emission rate from continuous emission monitor readings, and comparing this value to the emission standards (0.30 lbs/MMBtu for oil and 0.20 lbs/MMBtu for gas). For the remainder of the year, the calculated 30-day rolling average emissions rate was used to establish compliance. In CY 2001, there were no measured exceedances of the NOx emission standard for either boiler. For the year, NOx emissions from Boiler 6 averaged 0.265 lbs/MMBtu when No. 6 oil was burned and 0.107 lbs/MMBtu for natural gas. Similarly, the annual average NOx emissions recorded by the continuous emission monitors on Boiler 7 when No. 6 oil and natural gas were burned were 0.246 lbs/MMBtu and 0.097 lbs/MMBtu respectively.

Boiler 7 flue gas opacity is measured by a transmissometer mounted on the stack above the CSF roofline. Opacity readings are taken at 15-second intervals and reported as 6-minute averages. During the year, there were no measured exceedances of the opacity standard.

Groundwater

The MPF's groundwater monitoring program is designed to confirm that the engineered and institutional controls in place are effective in preventing contamination of the aquifer. In April 2000, five wells (076-16, 076-17, 076-18, 076-19 and 076-25) were used to monitor for potential contaminant releases (Figure 1). By October 2000, BNL incorporated three new wells (076-378, 076-379 and 076-380) into the MPF monitoring program.

Presently, the MPF stores primarily No. 2 and No. 6 fuel oil. Groundwater contaminants from these products can travel both as free product and in dissolved form with advective groundwater flow. The need to monitor for both forms of transport is reflected in the MPF groundwater monitoring plan. In accordance with the Special License Conditions, groundwater samples are analyzed semiannually for the Polynuclear Aromatic and Base Neutral Compounds contained in USEPA test method 625. During CY 2001, none of the target compounds were detected (Cunniff, 2001b; Cunniff, 2001e). The MPF wells were tested monthly for the presence of floating petroleum hydrocarbons. As in previous years, no floating product was observed.

SPDES Monitoring

Storm water from the CSF area is discharged to a headwall located approximately 900 feet east of Building 610. This discharge is regulated under the BNL State Pollutant Discharge Elimination System (SPDES) permit, Outfall 010. This discharge point receives storm water run-off from the area around the CSF, North 6th Street east of the CSF, and Cornell Avenue north of the CSF. Run-off from the head wall follows a shallow swale that terminates at a firebreak road. Water ponds in the area until it overflows the firebreak road and travels further eastward. Historical analyses of storm water samples collected at this headwall have periodically shown elevated levels of lead. The concentrations in samples collected at this location have ranged from non-detectable to approximately 100 μg/L. The New York State groundwater discharge standard for lead is 50 μg/L. Because several samples exceeded this regulatory limit, an investigation has been on going into the potential sources of lead. Investigations conducted during 2000-2001 have shown extremely high levels of lead in near-surface soils at the outfall.

In 2000, soil samples were collected just down stream of the outfall. Analyses showed lead concentrations ranging from 3,380 mg/Kg to 8,600 mg/Kg. These data were reported in the 2000 Site Environmental Report (BNL, 2001). In follow-up to the CY 2000 findings, seven additional soil samples were collected in October 2001 to better define the extent of lead contamination (Lee, 2001). The seven samples had lead concentrations ranging from 2,120 mg/Kg to 55,200 mg/Kg, exceeding the 400 mg/Kg soil cleanup Action Level established by the Suffolk County Department of Health Services. In addition to lead, elevated levels of cadmium, copper, and vanadium were also present. Vanadium is typically associated with combustion by-products, and its presence in the soils at such high concentrations indicates that the CSF is a likely source of contamination. Due to the extremely high concentrations of lead detected in the soil samples, an aliquot of the worst case sample collected during 2001 was prepared following the Toxicity Characteristic Leaching Procedure (TCLP) and was analyzed for RCRA regulated metals to evaluate these soils for hazardous waste characteristics. The TCLP analysis revealed a lead concentration of 10.6 mg/L, which exceeds the RCRA hazardous waste level of 5 mg/L. Soils removed from this area will have to be disposed as a hazardous waste, D008, unless commingling reduces the lead concentrations to < 5 ppm.

During the mid 1970s through the early 1990s, the Laboratory participated in an alternate liquid fuels (ALF) program. This program consisted of purchasing various types of fuel, or other combustible liquids from governmental agencies and the private sector. These fuels were stored and mixed with residual fuel and burned at the CSF. The fuels were composed of waste oils, jet fuel, and waste organic solvents. A review of available documentation for the ALF program shows that the fuel had lead concentrations up to 300 ppm. The fuels were blended with virgin No. 6 fuel oil in quantities to produce a product similar in characteristics to No. 4 fuel. Due to the waste nature of some of the ALF products, ash/slag buildup in the boilers was heavier than normal, and required frequent removal via water washing. All wastewater generated by this process was discharged to the CSF floor drains. Until the early 1980's, the floor drains discharged to

the storm water collection system. The floor drains were subsequently redirected to the BNL sanitary sewer. This wastewater most likely contained elevated metals due to the high levels contained in the waste oils. Elevated levels of vanadium detected in soil samples collected at the headwall are indicative of a fuel-based source, which further supports that the boiler wash water is the most likely source of the lead and other inorganic contaminants.

Future Monitoring Actions

The following actions are recommended for CY 2002:

- Maintain the groundwater monitoring program on its current semiannual schedule and incorporate new NYSDEC requirements for testing for volatile organic compounds and methyl tertiary butyl ether (MTBE).[1]
- Maintain the air monitoring program on its current schedule as required by the NYSDEC license.
- Additional information is required to adequately characterize the areal extent of lead contamination of soils near SPDES Outfall 010. Once the areal extent is fully defined a plan to address the contaminated soils will be developed. Partial excavation of the area is planned for early 2002 to allow for visual inspection of the impacted soils, and provide access for detailed sampling.

References

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[1] New monitoring requirements defined in updated NYSDEC License 1-1700 dated March 8, 2002.

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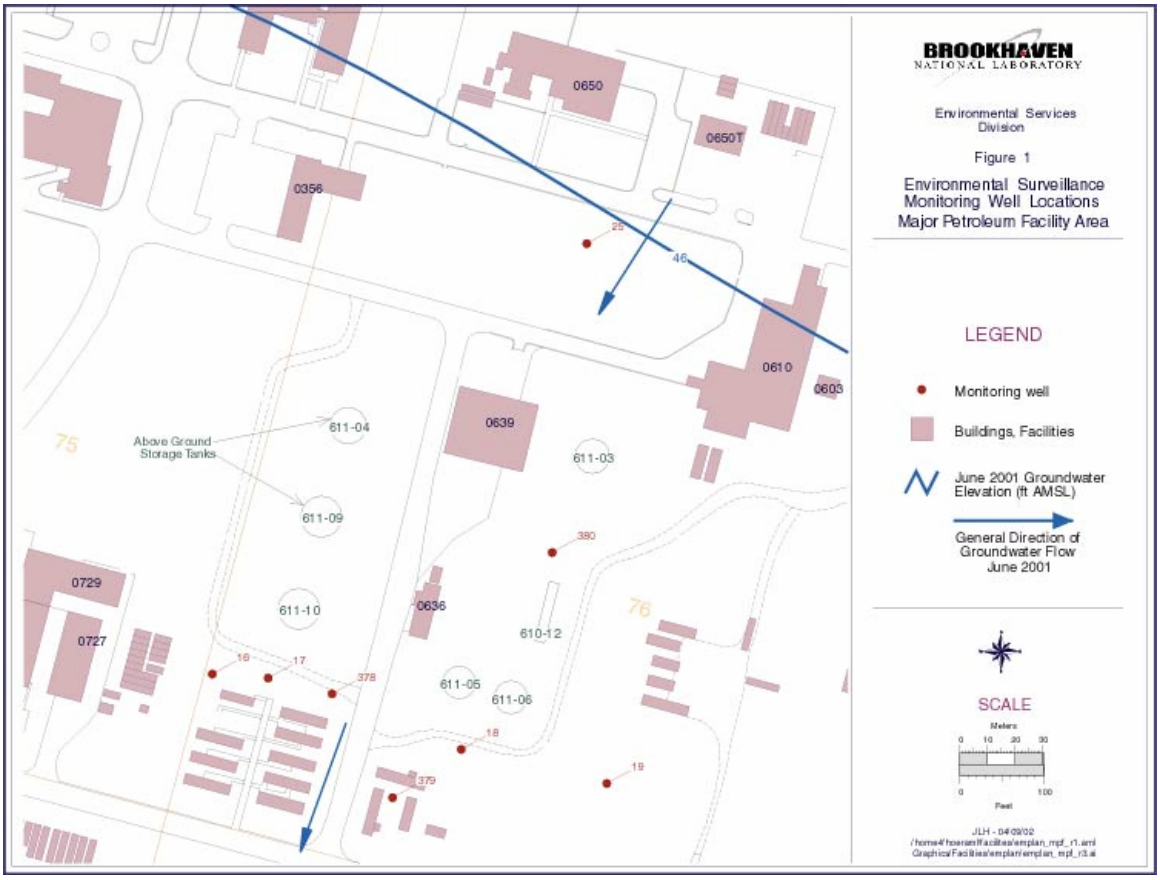
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Figure 1
Environmental Surveillance
Monitoring Well Locations
Major Petroleum Facility Area
LEGEND
Monitoring well
Buildings, Facilities
June 2001 Groundwater
Elevation (ft AMSL)
General Direction of
Groundwater Flow
June 2001
SCALE
Meters
0 10 20 30
0 100
Feet
JLH - 04/09/02
/home4/hoerstf/facilities/emplan_mpf_r1.aml
Graphics/Facilities/emplan/emplan_mpf_r3.ai
0650
0650T
0356
0610
0603
0639
0729
0727
0636
611-04
611-09
611-10
611-03
610-12
611-05
611-06
Above Ground
Storage Tanks
75
76
25
46
380
16
17
378
18
19
379